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H03J 5/00

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UK CL (Edition K) H3Q QCD, H4L LERM
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(54) RDS radio with storage of transmitted other network information

(57) A method is discosed of controlling an RDS radio receiver which is provided with a preset memory having addresses for a plurality of frequency data elements per preset channel, and which can receive an RDS broadcast including data signals indicative of categories and station-frequencies of a plurality of networks different from a network to which a station transmitting the RDS broadcast belongs. Data signals are sampled from the received broadcast and category data and station-frequency data of other networks are read from the sampled data. The station frequencies of network stations belonging to the same network are stored in memory addresses in the preset memory corresponding to a preset channel when a preset instruction is given.

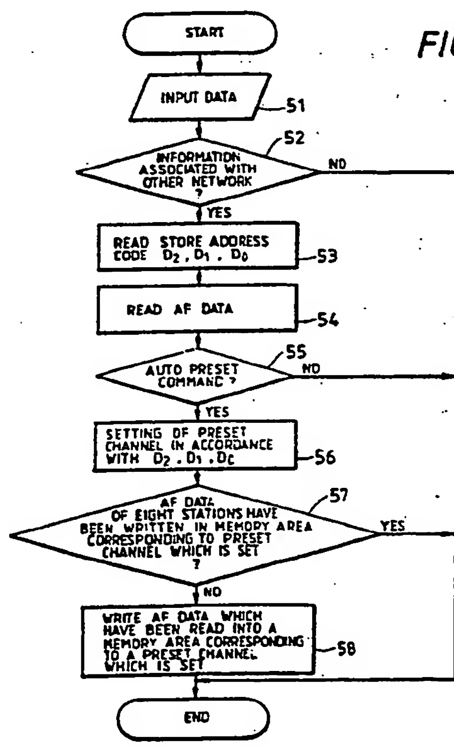

FIG. 7

The date of filing shown above is that provisionally accorded to the application in accordance with the provisions of Section 15(4) of the Patents Act 1977 and is subject to ratification or amendment.

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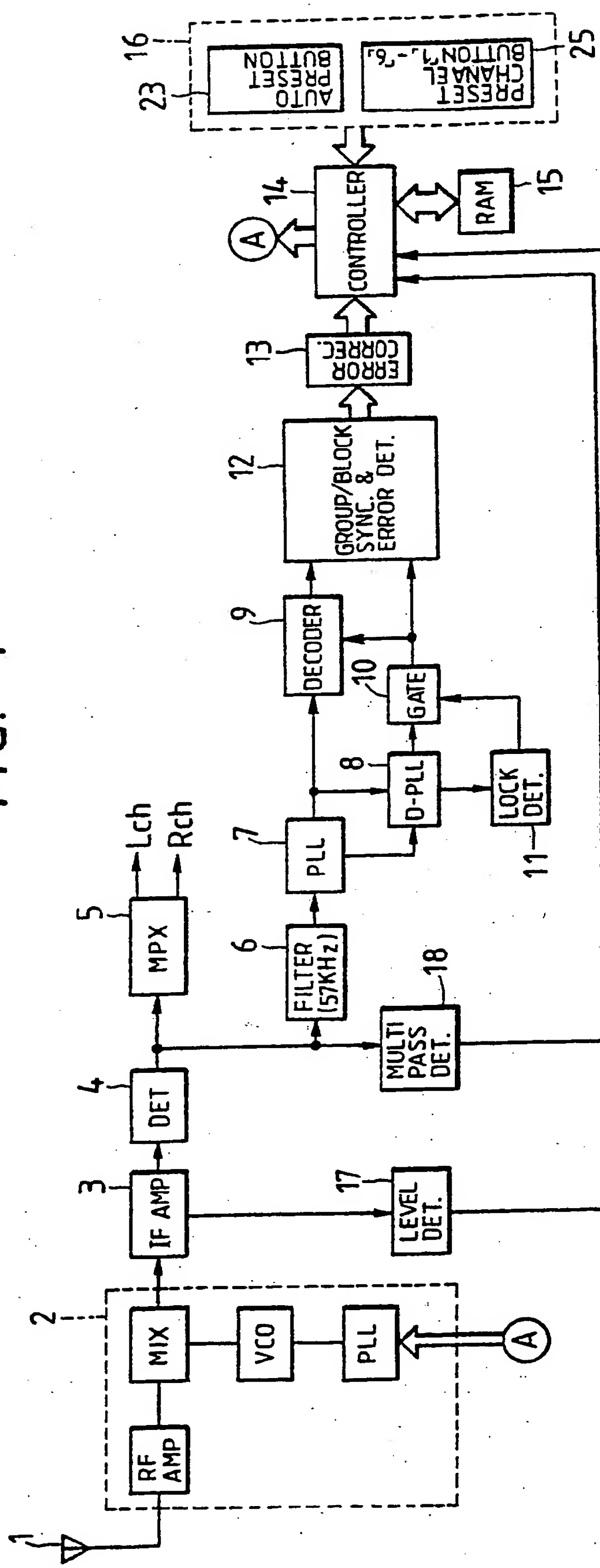


RF AMP
MIX
VCO
PLL
A
IF AMP
DET
MPX
Lch
Rch
FILTER (57KHz)
PLL
D-PLL
LOCK DET.
DECODER
GATE
GROUP/BLOCK SYNC. & ERROR DET.
ERROR CORREC.
CONTROLLER
RAM
AUTO PRESET BUTTON
PRESET CHANNEL BUTTON "1"-"6"
LEVEL DET.
MULTI PASS DET.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
23
25

FIG. 1

FIG. 2

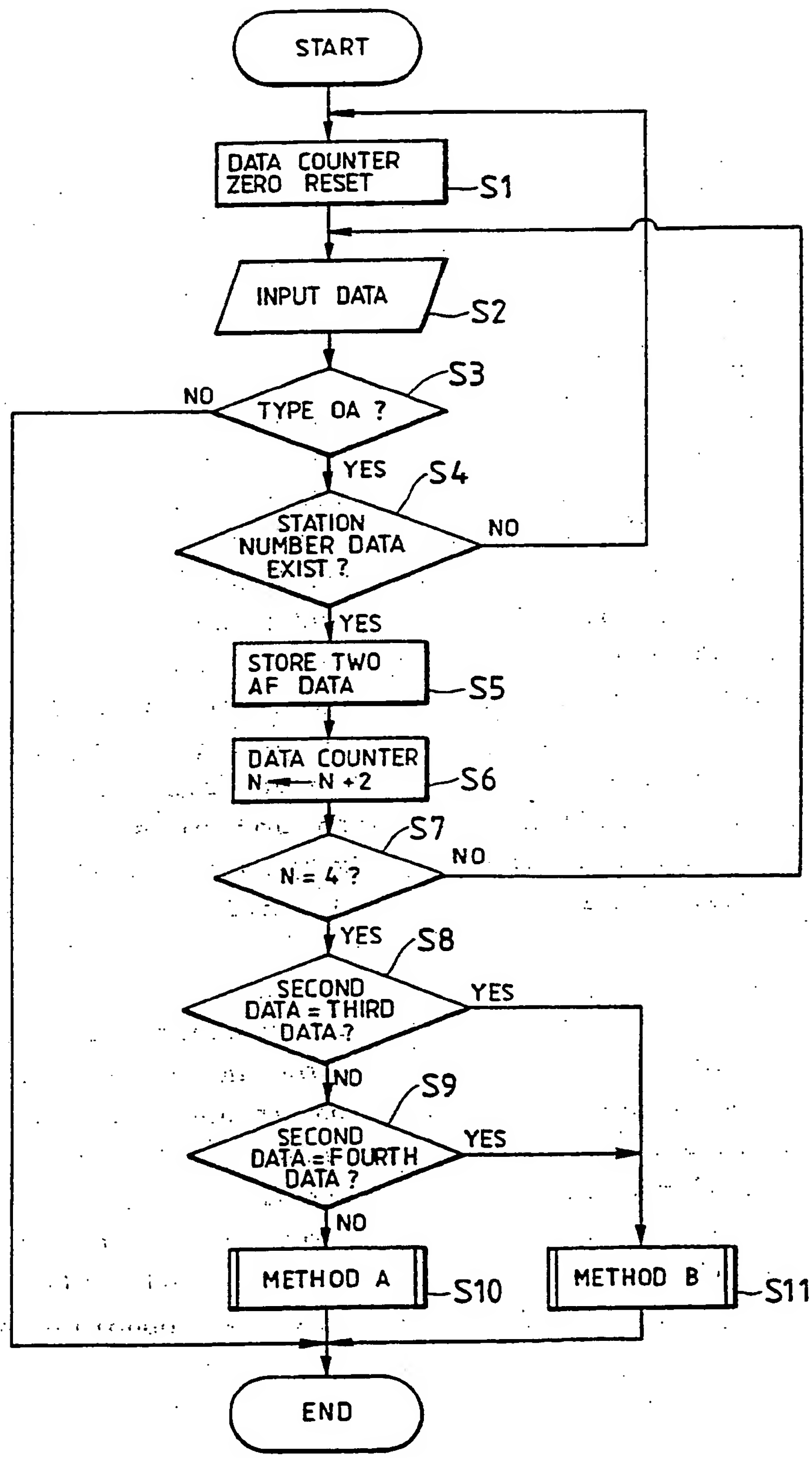

START
DATA COUNTER ZERO RESET
S1
INPUT DATA
S2
TYPE OA ?
S3
NO
YES
STATION NUMBER DATA EXIST ?
S4
NO
YES
STORE TWO AF DATA
S5
DATA COUNTER N ← N + 2
S6
N = 4 ?
S7
NO
YES
SECOND DATA = THIRD DATA ?
S8
YES
NO
SECOND DATA = FOURTH DATA ?
S9
YES
NO
METHOD A
S10
METHOD B
S11
END

FIG. 3

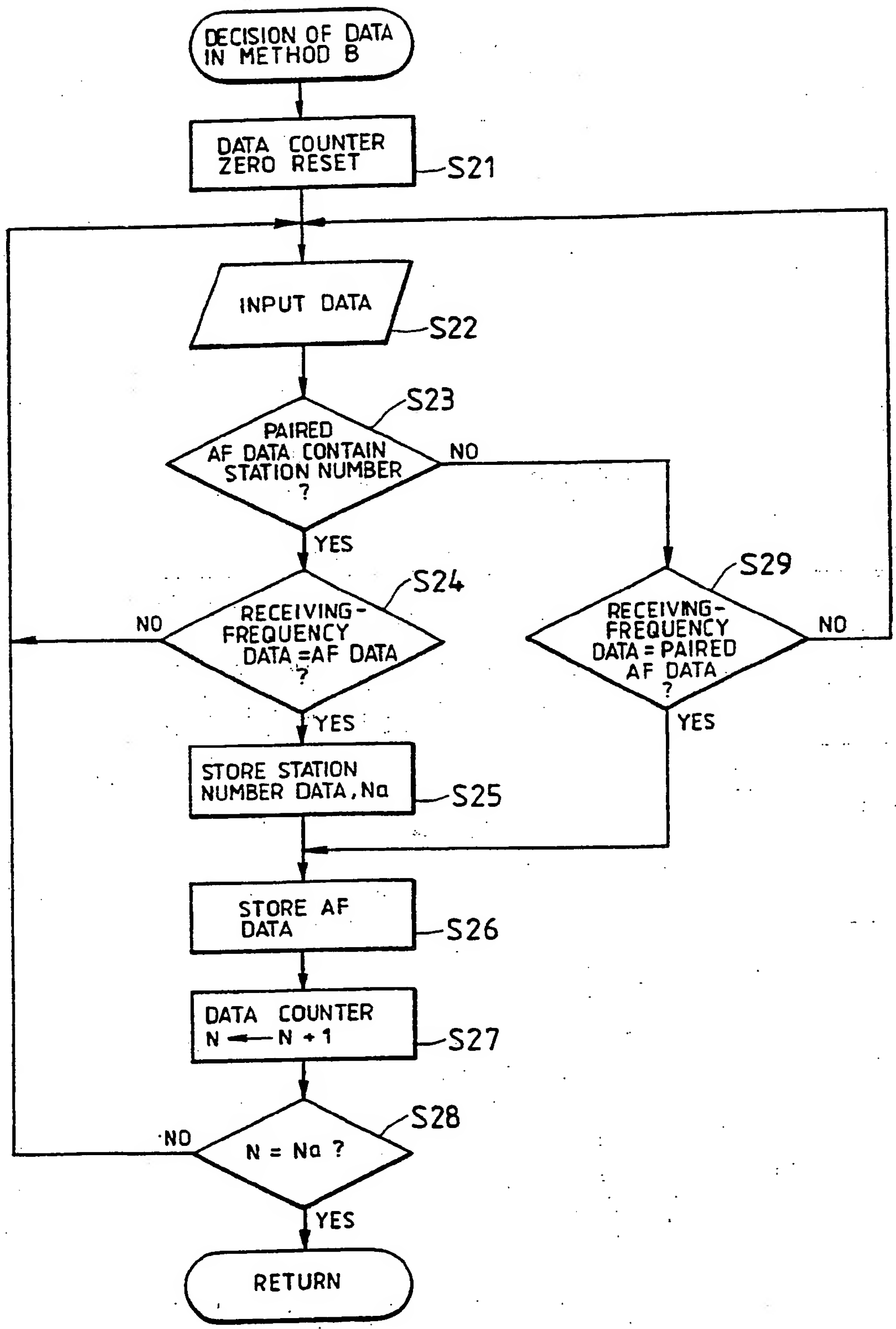

DECISION OF DATA IN METHOD B
DATA COUNTER ZERO RESET
S21
INPUT DATA
S22
S23
PAIRED AF DATA CONTAIN STATION NUMBER ?
NO
YES
S24
RECEIVING-FREQUENCY DATA =AF DATA ?
NO
YES
STORE STATION NUMBER DATA, Na
S25
S29
RECEIVING-FREQUENCY DATA = PAIRED AF DATA ?
NO
YES
STORE AF DATA
S26
DATA COUNTER N ← N + 1
S27
S28
N = Na ?
NO
YES
RETURN

FIG. 4

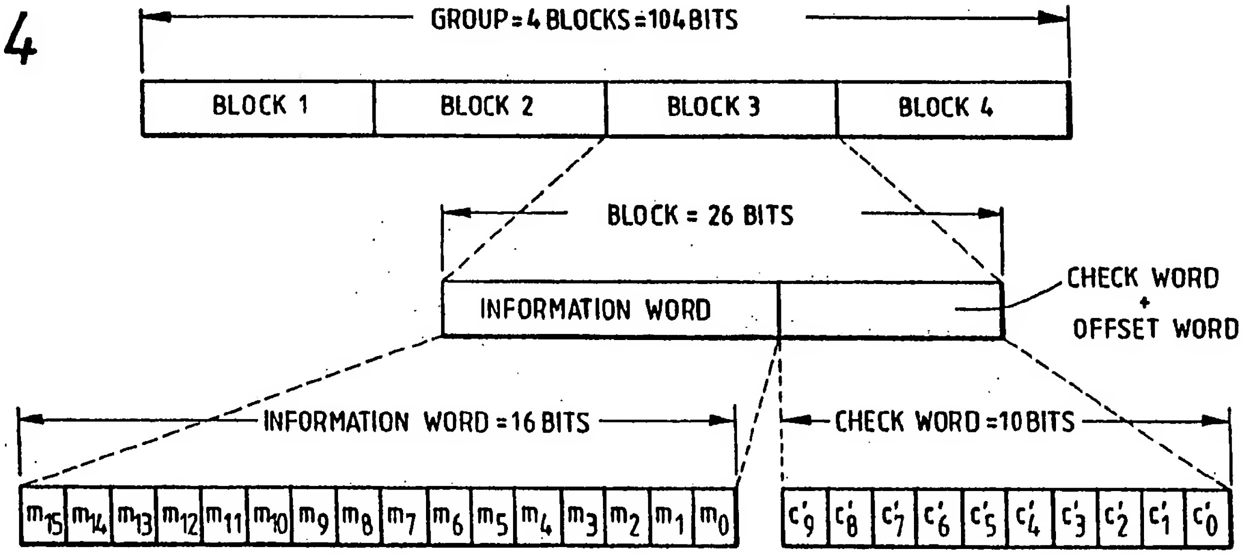


FIG. 5(A)

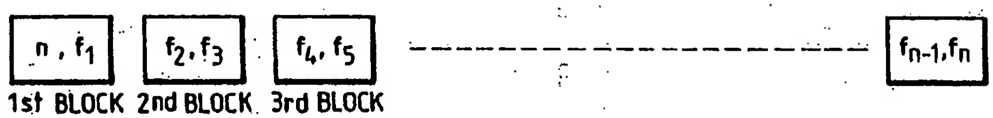


FIG. 5(B)

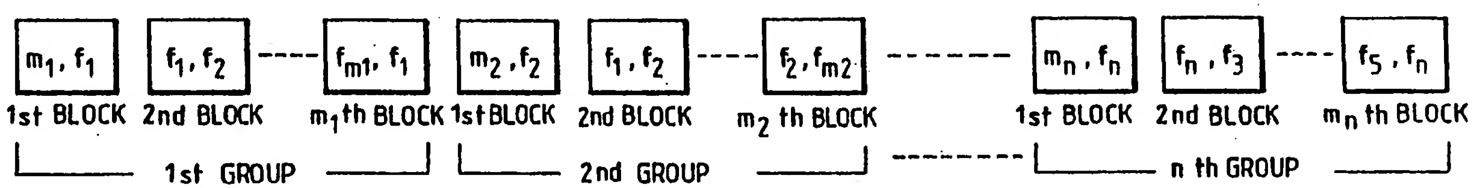


FIG. 6

		PRESET CHANNEL					
		1ch	2ch	3ch	4ch	5ch	6ch
PRESET MEMORY AREA	1st STATION						
	2nd STATION						
	3rd STATION						
	4th STATION						
	5th STATION						
	6th STATION						
	7th STATION						
	8th STATION						

FIG. 10

		PRESET CHANNEL					
		1ch	2ch	3ch	4ch	5ch	6ch
PI MEMORY AREA							
PRESET MEMORY AREA	1st STATION						
	2nd STATION						
	3rd STATION						
	4th STATION						
	5th STATION						
	6th STATION						
	7th STATION						
	8th STATION						

FIG. 7

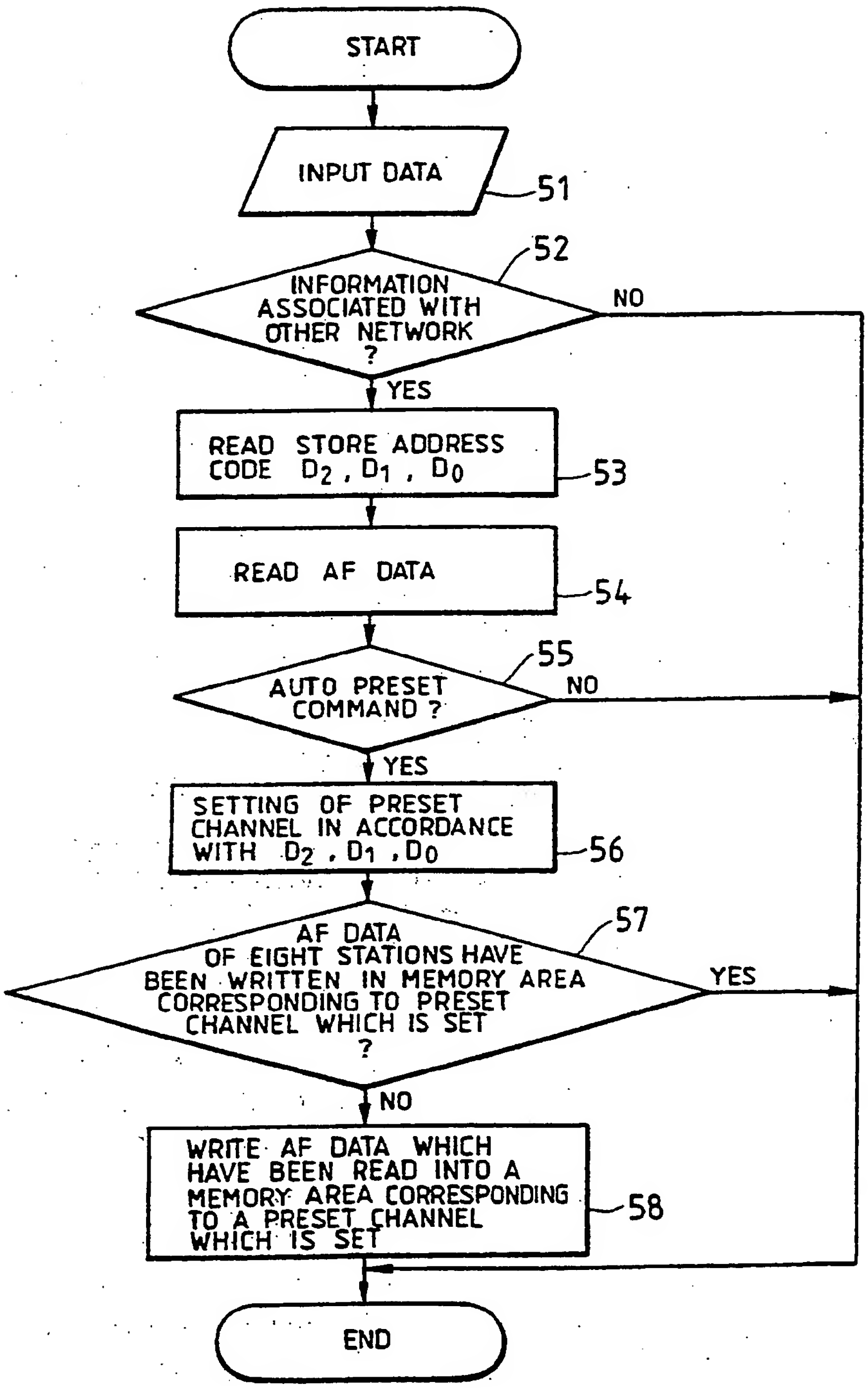

START
INPUT DATA
51
52
INFORMATION ASSOCIATED WITH OTHER NETWORK ?
NO
YES
READ STORE ADDRESS CODE D2 , D1 , D0
53
READ AF DATA
54
55
AUTO PRESET COMMAND ?
NO
YES
SETTING OF PRESET CHANNEL IN ACCORDANCE WITH D2 , D1 , D0
56
57
AF DATA OF EIGHT STATIONS HAVE BEEN WRITTEN IN MEMORY AREA CORRESPONDING TO PRESET CHANNEL WHICH IS SET ?
YES
NO
WRITE AF DATA WHICH HAVE BEEN READ INTO A MEMORY AREA CORRESPONDING TO A PRESET CHANNEL WHICH IS SET
58
END

FIG. 8

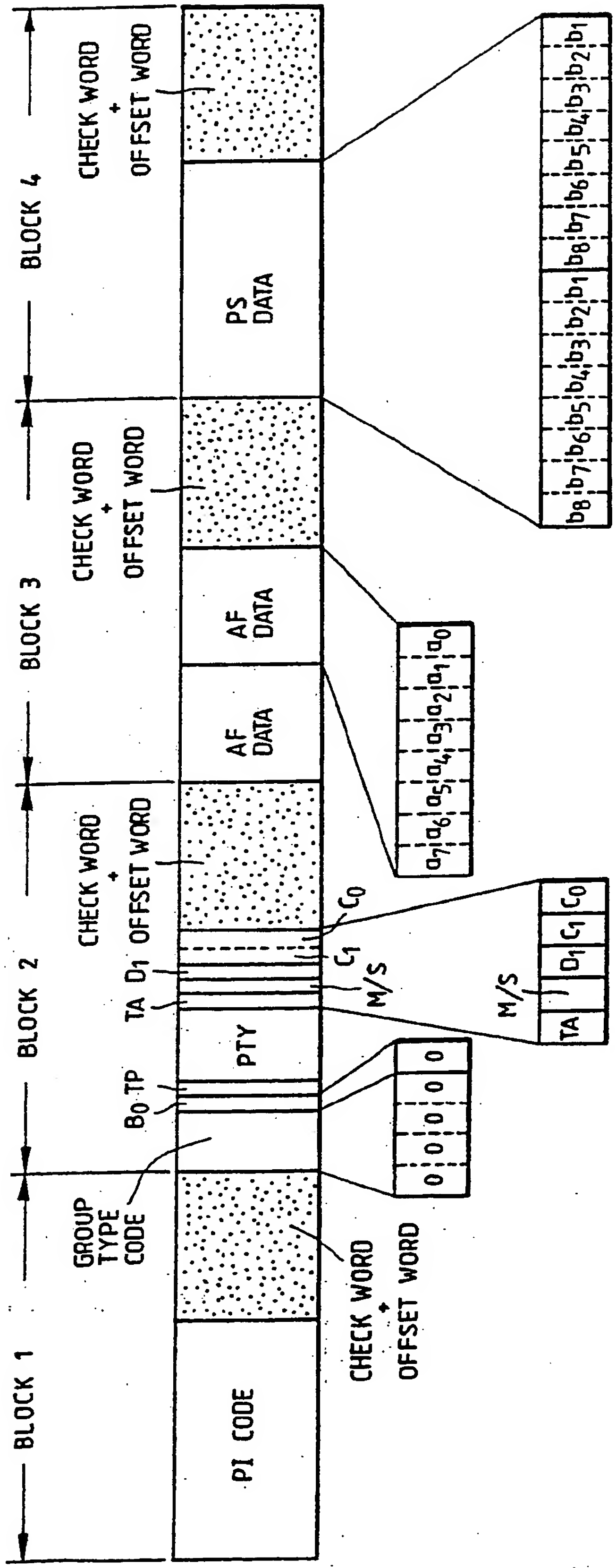

BLOCK 1
BLOCK 2
BLOCK 3
BLOCK 4
PI CODE
CHECK WORD + OFFSET WORD
GROUP TYPE CODE
B0 TP
PTY
TA D1
M/S
C1
C0
0 0 0 0 0
TA M/S D1 C1 C0
AF DATA
AF DATA
a7 a6 a5 a4 a3 a2 a1 a0
PS DATA
b8 b7 b6 b5 b4 b3 b2 b1 b8 b7 b6 b5 b4 b3 b2 b1

FIG. 9

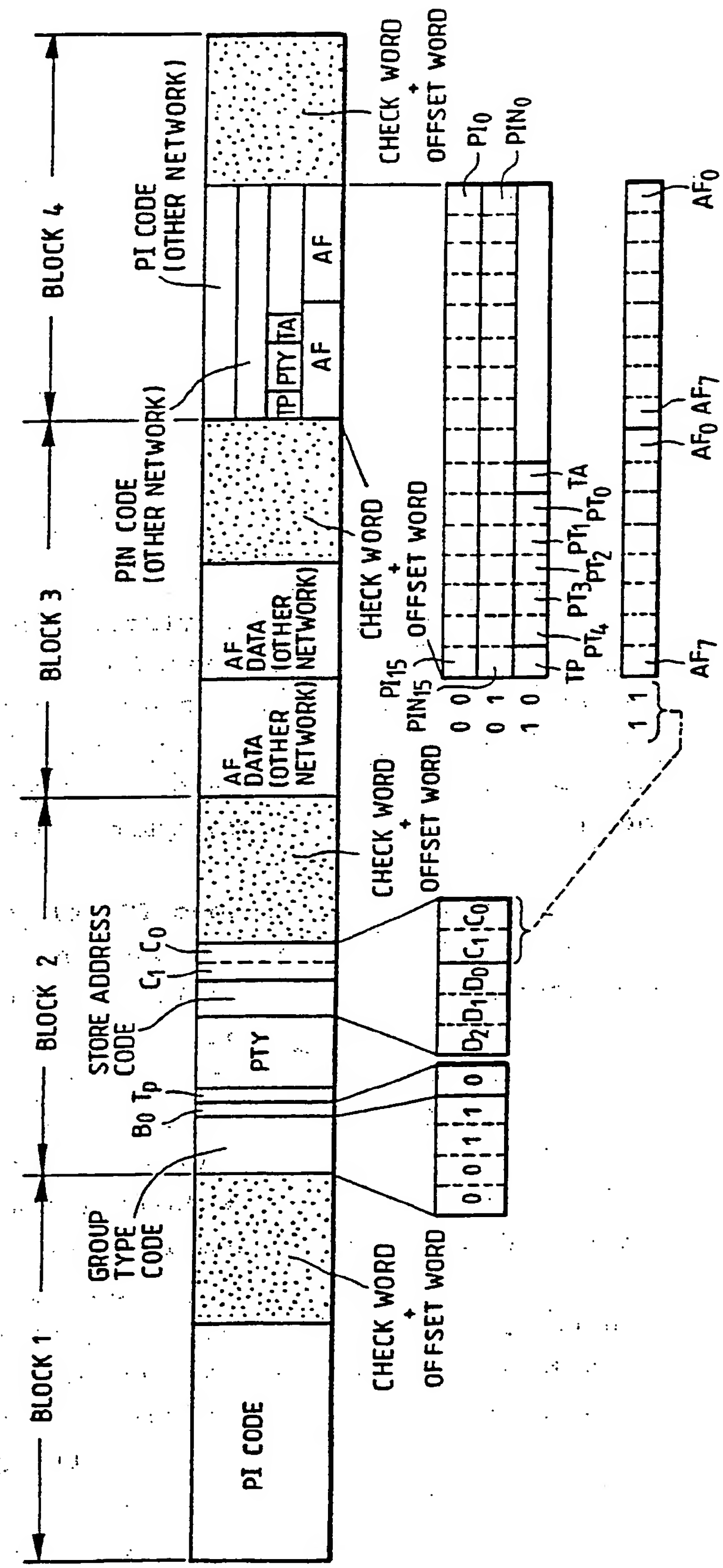
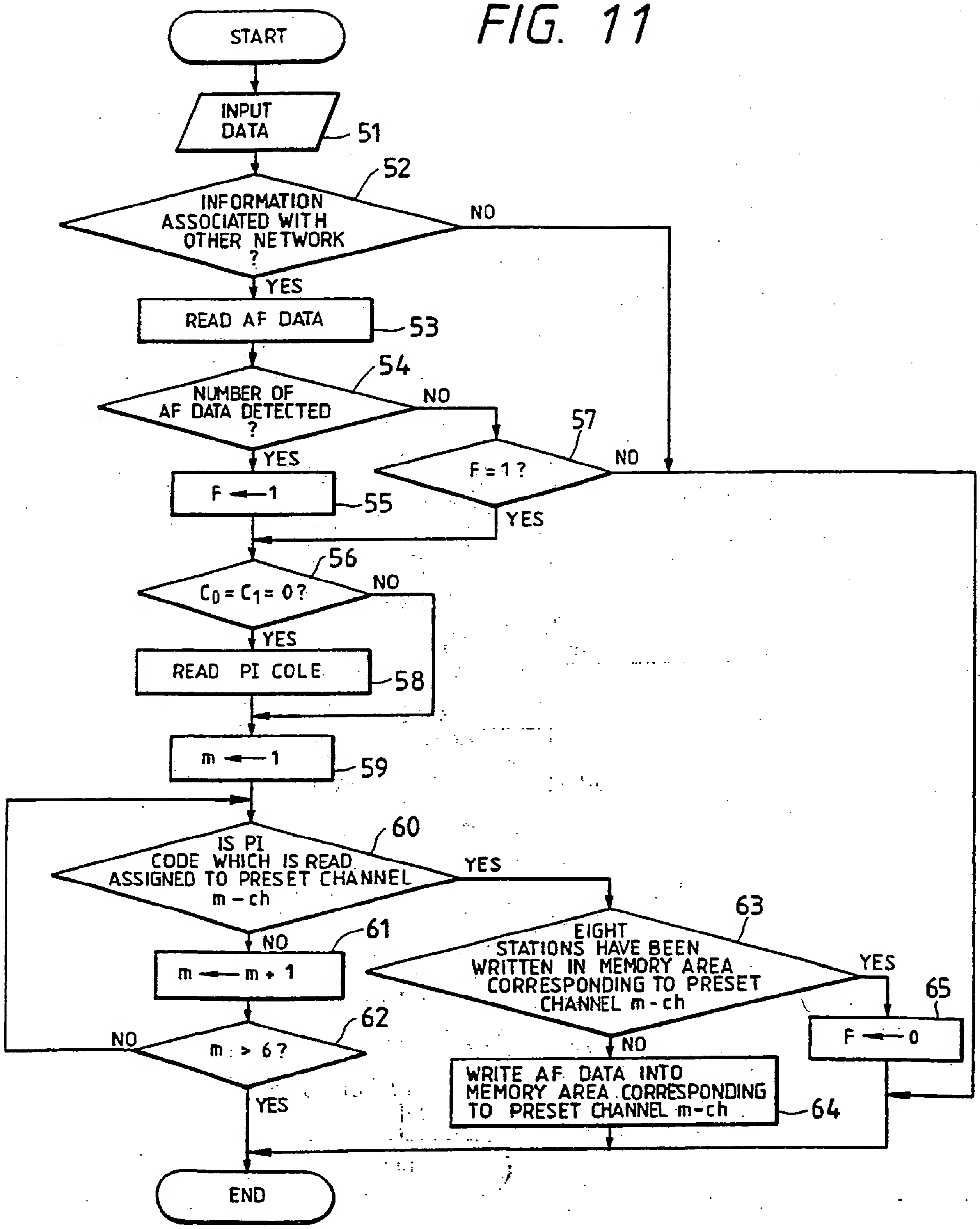

BLOCK 1
BLOCK 2
BLOCK 3
BLOCK 4
PI CODE
CHECK WORD + OFFSET WORD
GROUP TYPE CODE
B_0 T_p
PTY
STORE ADDRESS CODE
C_1 C_0
CHECK WORD + OFFSET WORD
AF DATA (OTHER NETWORK)
AF DATA (OTHER NETWORK)
PIN CODE (OTHER NETWORK)
CHECK WORD + OFFSET WORD
PI CODE (OTHER NETWORK)
TP PTY TA
AF
AF
CHECK WORD + OFFSET WORD
0 0 1 1 0
D_2 D_1 D_0 C_1 C_0
0 0
0 1
1 0
1 1
PI_{15}
PIN_{15}
PI_0
PIN_0
TP
PT_4 PT_3 PT_2 PT_1 PT_0
TA
AF_7
AF_0 AF_7
AF_0

FIG. 11


START
INPUT DATA
51
INFORMATION ASSOCIATED WITH OTHER NETWORK ?
52
NO
YES
READ AF DATA
53
NUMBER OF AF DATA DETECTED ?
54
NO
YES
F ← 1
55
F = 1 ?
57
NO
YES
$C_0 = C_1 = 0$?
56
NO
YES
READ PI COLE
58
m ← 1
59
IS PI CODE WHICH IS READ ASSIGNED TO PRESET CHANNEL m − ch
60
YES
NO
m ← m + 1
61
m : > 6 ?
62
NO
YES
EIGHT STATIONS HAVE BEEN WRITTEN IN MEMORY AREA CORRESPONDING TO PRESET CHANNEL m - ch
63
YES
NO
F ← 0
65
WRITE AF DATA INTO MEMORY AREA CORRESPONDING TO PRESET CHANNEL m-ch
64
END

RADIO DATA SYSTEM (RDS) RADIO RECEIVER AND METHOD OF CONTROLLING SAME

The present invention relates generally to a radio data system (RDS) receiver and more particularly to a method of identifying the method of transmission of frequency information data in radio data systems and to controlling operation of an RDS receiver.

A radio data system (RDS) has been proposed for providing radio listeners with a service in which when an ordinary radio station broadcasts a program, information associated with the broadcast, such as details of program contents is transmitted as data through multiplex modulation, thereby permitting the radio listener to select program contents of their preference on the basis of the data received and demodulated at a reciever.

With this radio data system (RDS), a subcarrier of 57KHz which resides outside the band occupied by FM modulation signals and which is the third harmonic of a 19 KHz stereo pilot signal, is amplitude modulated by a data signal which is filtered and biphase-coded, representative of the program contents, thereby providing radio data signals. A main carrier wave is frequency modulated by this amplitude modulated subcarrier, and then the main carrier is broadcast.

Fig. 4, diagramatically indicates a base band coding structure of a radio data signal which consists of 104 bits to form one group and which is multiplex transmitted in a repeated manner.

One group consists of four 26-bit blocks, each block consisting of a 16-bit information word and a 10-bit checkword. Fig. 8 shows block 1 assigned a program identity code (PI), block 2 a traffic program identity code (TI) or traffic anouncement identity code (TA), block 3 the station frequency code (AF) of a network station which is broadcasting the same program as the station currently being received, and block 4 program service information

data (PS) such as a station name or network name. Each group is distinguished by 4 bits into 16 types, i.e. type 0 to type 15 differing in contents. Further, two versions, version A and version B are defined with respect to respective types (0 to 15). These identification codes are located in block 2. The station frequency code (AF) of the network station is arranged to be transmitted only by type 0 group A and PS data by type 0, group A and type 0, group B. In this manner, the radio data of the type 0, group A contains AF data of the network stations which are broadcasting the same program as the station currently being received. When the broadcasting wave is received, the AF data obtained by demodulating the broadcasting wave is read and then stored, and when the receiving sensitivity of the station currently being received has become poor due to disturbances such as multipath interference, other network stations can be selected instead on the basis of the AF data of the network stations stored previously, thereby enabling radio listners to listen to the same program with a good receiving condition free from disturbances.

There are two methods of transmitting this AF data. In a first method A, a plurality of blocks are defined, as shown in Fig. 5(A), to contain AF data (f_1 to f_n) for up to twenty five network stations which are broadcasting the same program without regard to whether or not that station can be received, each block containing the AF data for two stations. A first data element in the first block indicates the number of stations, n in that network. This group of blocks is transmitted sequentially in a repeated manner.

In method B, a plurality of groups of stations are defined on the basis of network stations (f_1 to f_n) broadcasting identical programs, each group consisting of a centre station and network stations in an area which can be received, as shown in Fig. 5(B). Each block contains the AF data for a pair of stations which are broadcasting

identical programs, one a centre station in that group, and the other a station within that group. A first data element in a first block of each group represents the number m_n of stations in that group. This group of blocks is transmitted sequentially in a repeated manner. The order of locating the two paired stations in each block is determined depending on which station is higher or lower in frequency than the other. In both methods A and B, the AF data consists of 8 bits and is located in block 3 (of Fig. 4) to be transmitted as a 16-bit (2x8 bit) information word. The broadcasting stations decide which of methods A and B is used in a particular case.

The existence of these two different methods of transmitting the AF data naturally assumes two different methods of processing the AF data after demodulating the radio data at a receiving site. Therefore it is required to promptly and reliably identify which method A or B the AF data is transmitted by.

One object of the invention is to provide a method, in a radio data system, which can identify the transmission method of the AF data reliably in a short time.

Additionally, information associated with stations of other networks different from the network to which a broadcasting station currently being received belongs, is transmitted by type 3. Fig. 9 shows a format of type 3, group A, which obtains in block 3 the AF data of stations of other networks, and in block 4 any one of PI code as information associated with stations of other networks, program number code (PIN), TP code, program type code (PTY), TA code, or AF data is located in correspondence to codes C_1 and C_0 in block 2. The information in block 4 is also transmitted by block 4 of type 3, group B. Store address codes D_2, D_1, D_0 are provided in block 2 to categorize other networks currently on the air taking into consideration that there exists a plurality of other networks, thereby enabling transmission of the information associated with up to eight other networks.

Since receiving one of the stations of RDS broadcasting can provide information associated with other networks, it would be convenient if a receiver could quickly be switched from the station currently being received to a station of one of a plurality of other networks which are broadcasting programs different from the program of the station currently being received.

Thus a further object of the invention is to provide a method for controlling an RDS receiver which method can quickly select a station from another network different from the network to which the station currently being received belongs by utilising information associated with other networks.

A further object of the present invention is to provide a method for controlling an RDS receiver in which when selecting a station of another network which is broadcasting a program different from the program of the station currently being received, a station of the other network is easily selected with a good receiving condition by effectively utilising the information associated with the other networks.

According to the invention a method is provided for controlling an RDS radio receiver which is provided with a preset memory having addresses for a plurality of frequency data elements per preset channel, and which can receive an RDS broadcast including data signals indicative of categories and station-frequencies of a plurality of networks different from a network to which a station transmitting the RDS broadcast belongs, the method including the steps of:

sampling data signals from the received broadcast;

reading category data and station-frequency data of other networks from the sampled data; and

storing the station frequencies of network stations belonging to the same network in memory addresses in the preset memory corresponding to a preset channel when a preset instruction is given.

Preferably, this method includes searching for an address in the memory in which the same category data as the category data that is read from the RDS broadcasting when another station is selected and subsequently an RDS broadcast is received; and

revising data in the memory by writing in the respective address the frequency data for a station in the other network which is read from the broadcasting wave received.

The invention also includes an RDS radio receiver for carrying out the methods of the two aspects of the invention, in one aspect, having identifying means comprising means for reading station frequency data in the first and second blocks only from the data obtained by demodulating the received broadcasting wave; and means for comparing the station frequency data in the first and second blocks for coincidence, coincidence of data indicating the second method of transmissions and non-coincidence indicating the first method of transmission is being used for transmitting the data.

One example of a method according to the present invention will now be described with reference to the drawings in which:-

Fig. 1 is a block diagram showing a basic arrangement of an FM multiplex broadcasting receiver to which a method for identifying AF data transmission according to the present invention is applied;

Fig. 2 is a flow chart showing the procedure for identifying the method of AF data transmission according to the present invention which method is carried out by a processor;

Fig. 3 is a flow chart showing the procedure for selecting and storing AF data in method B, which procedure is carried out by a processor;

Fig. 4 is a diagram showing a structure of the base band coding of radio data;

Fig. 5 is a diagram showing locations of the paired AF data in accordance with the transmission method of AF data, (A) for method A, and (B) for method B.

Fig. 6 is a diagram showing a preset memory area in a RAM;

Fig. 7 is a flow chart for showing further operation of a processor in a controller of the receiver shown in Fig. 1;

Fig. 8 is a diagram showing the format of type 0, group A;

Fig. 9 is a diagram showing the format of type 3, group A.

Fig. 10 is a diagram showing an alternative preset memory area in a RAM; and,

Fig. 11 is a flow chart showing a corresponding alternative operation of the processor of a controller in a receiver shown in Fig. 1.

Referring to Figure 1, a desired station is selected at a front end 2 from FM multiplex broadcast radio waves received by an antenna 1 and is then converted into an intermediate frequency (IF). Then the intermediate frequency is supplied to an FM detector 4 through an IF amplifier 3. The front end 2 comprises, for example, an RF amplifier, a mixer, a voltage controlled oscillator (VCO), and a PLL synthesizer including a programmable frequency divider, the division ratio of which is controlled by a controller 14, which will be described later, to effect the operation of station selection. The detected output of the FM detector 4 is supplied to an MPL (multiplex) demodulator circuit 5 to produce audio signals separated into L (left) and R (right) channels if the program is in stereo mode. When the detected output of the FM detector 4 passes through a filter 6, a radio data signal or a subcarrier of 57 KHz which is amplitude modulated by a biphase coded data signal is sampled and is then demodulated in a PLL circuit 7. The demodulated output is supplied to a digital (D-PLL) circuit 8 and a decoder 9. The D-PLL circuit 8 produces a

clock for data demodulation on the basis of the demodulated output of the PLL circuit 7. The clock thus produced is supplied to a gate circuit 10. A lock detector circuit 11 detects that the D-PLL circuit 8 has been locked on, and generates a lock detection signal, which is supplied to the gate circuit 10 to cause the gate 10 to open. A data signal, which is a biphase coded output of the PLL circuit 7, is decoded in synchronism with the clock produced in the D-PLL circuit 8.

The output data of the decoder 9 is a group having 104 bits which consists of four 26-bit blocks as shown in Fig. 4, and is supplied sequentially to a group/block synchronism/error detection circuit 12. In the circuit 12, block synchronism with group is effected on the basis of 10-bit offset words assigned to 10-bit checkwords of respective blocks, respectively, while at the same time error detection of a 16-bit information word is effected on the basis of the checkword. Then the error-detected data is subsequently corrected at an error correction circuit 13 and is supplied to the controller 14.

The controller 14 may be formed by a microcomputer (microprocessor), which reads the code information of the respective blocks in the radio data or radio information (PI code, AF data, PS data etc.) associated with the program currently being received, the information being input to the controller 14 sequentially group by group, and stores the information in a memory 15 such as a RAM. The controller 14 also controls, on the basis of station selection command from an operation unit 16, the receiving-frequency data for determining the division ratio of the programmable divider (not shown) of the PLL circuit which is a part of the front end 2, thereby effecting station selection. The frequency to be received is the counted value of a counter for example. Operation of the memory 15 and preset channel selection will be described later.

The output of a level detection circuit 17 for detecting decrease in signal strength on the basis of the IF signal level, and the output of a multipath detection circuit 18 for detecting multipath interference on the basis of the FM detector output, are supplied to the controller 14. When these detector outputs are supplied to the controller 14, the controller 14 recognizes if the receiving condition of the station currently being received has become poor, and then the controller 14 controls the division ratio of the programmable divider so that an other station in the network can be selected on the basis of the AF data of the network which has previously been stored in the memory 15.

The procedure for identifying AF data transmission method, which is carried out by the processor of the controller 14, according to the present invention will now be described with reference to the flow chart in Fig. 2.

The processor first resets an internal data counter to zero (step S1), then reads the radio data (step S2). On the basis of the group type code and the version code located in block 2 of the radio data which has been read, a decision is made based on whether or not the group is type 0, group A, i.e. whether or not AF data is contained in the radio data (step S3). If it is not type 0, group A, then AF data is not obtained, in which case it is not necessary to identify the transmission method of the AF data thus terminating the operation of identifying. If it is type 0, group A, then a decision is made based on whether or not the number-of-station data indicative of the number of stations broadcasting the same program is contained in the AF data for two stations obtained from the radio data. That is to say, a decision is made based on whether or not the data elements are the two data elements that are contained in the first block shown in Fig. 5 (step S4), and if the data does not contain the number-of-station data, then the procedure reverts to S1 to repeat the aforementioned steps. If the data contains the

number-of-station data, then the combination of the number-of-station data and the corresponding AF data is stored in the memory 15 (step S5). Then the data element count is incremented by two (step S6) and a decision is made based on whether or not the count value N is 4 (or whether or not reading of two blocks, (i.e. four data elements) is completed) (step S7). If N is not equal to 4, then the procedure reverts to step S2 to read the AF data until N is equal to 4.

If N is equal to 4, then a decision is made based on whether or not the second data element of four data elements stored in the memory 15 is equal to the third AF data element or the fourth AF data element (step S8, S9). If the second data element is equal to neither the third AF data element nor the fourth AF data element, the transmission method of AF data is recognized as being method A and then all the data in the blocks after the fourth block are read to be stored in the memory 15 (step S10). On the other hand, if AF data is recognized as being equal to the third data element at step S8 or equal to the fourth data element at step S9, then the transmission method of AF data is recognized as being method B and then the processor selects, for example, from many AF data only the AF data of a group in which the station currently being received is the centre frequency, and then stores the AF data.

As is apparent from Fig. 5, each block does not contain the same AF data in the other blocks in diagram (A) indicative of method A, while the AF data of the centre station of the group necessarily exists in respective blocks of the group in diagram (B) indicative of method B. Thus identifiction of the transmission method of AF data is effected reliably in a short time by comparing the AF data of two blocks obtained sequentially from radio data of type 0, group A to find coincidence between them.

Also, in method B, by virtue of an arrangement that the data of the two blocks are read, the first block

containing the number-of-station data and subsequently the second block, reliable reading of the data of the two blocks which belong to the same group is ensured. Further, data comparison between only two blocks is required thereby permitting not only more reliable identification of transmission method in a short time but also confirmation of the number of AF data elements at the same time.

The procedure of selecting and storing AF data which is carried out by the processor as a subroutine when the transmission method of data is identified as being method B at step S11 in Fig. 2, will now be described with reference to the flow chart shown in Fig. 3.

The processor first resets the internal data counter to zero (step S21), then reads AF data block by block i.e., a pair of AF data elements (step S22) to make a decision based on whether or not the number-of-station data element is indicative of the number of the network stations in that group (step 23). In the case where the paired AF data elements contain the number-of-stations data, a decision is made based on whether or not the AF data of the centre station which is the pair to that number-of-stations data is same as the frequency of the station currently being received. If the answer is "No", then the procedure reverts to step S22. If the answer is "Yes", then the number-of-stations data Na is stored in an internal register (step S25), then the AF data of the centre station is stored in the memory 15 (step S26) and the count value N of the data counter is incremented by "1" (step S27). Thereafter the count value N of the data counter is compared with the value Na of the internal register (step S28). If N is not equal to Na, then the procedure reverts to step S22, alternatively if N is equal to Na, then the AF data selection procedure is completed. On the other hand, if the paired AF data elements do not contain the number-of-stations data at step 23, then a decision is made based on whether or not one of the AF date elements which have been read is equal to the frequency of the station

currently being received (step S29). If the AF data is not equal to the frequency, then the procedure reverts to step S22 and if the AF data is equal to the frequency, then the procedure proceeds to step S26 to store the paired AF data in the memory 15. Repeating the above steps permits storage of all the AF data in the group whose centre station is the station currently being received i.e., only AF data of the stations which can be received, of all the stations in the network.

When the receiving condition becomes poor due to decreasing signal strength or multipath interference, if it is in method A, the controller 14 selects the AF data of a network station which can be received from all the network stations which have been stored in the memory 15 previously in response to the output of the level detection circuit 17 or multipath detection circuit 18; on the other hand, if it is in method B the controller 14 selects from the AF data in the group which has been selected and stored previously, in either case thereby permitting the radio listeners to listen to the same program without being interupted.

As described above, according to the invention, since identification of whether the AF data transmission method is method A or method B is accomplished by reading the AF data of only two blocks, the first and the second blocks out of those obtained through demodulation; and then comparing the data of one block with the other to find coincidence between the two blocks. Thus, the procedure of identifying the method can be carried out reliably in a short time. In method B, reading the first block containing the-number-of-stations data and then the second block following the first block always assures reading data of two blocks belonging to the same group. Also, data comparison is performed between only two blocks. Further the number of AF data elements can be checked at the same time as identification of the method.

Operation of the memory 15 and preset channel selection possible with the system will now be described.

The memory 15 consists of a non-volatile RAM into which data such as receiving-frequency data, PI code, AF data are written and a ROM into which a program and data are written in advance. In this RAM, there is provided a preset memory area in which frequency data of up to eight stations can be written per preset channel, channels, 1ch to 6ch. The operation unit 16 is provided with an autopreset button 23 for specifying autopreset operation and a plurality of preset channel operation buttons 25 for preset channel selection. When any one of the preset channel buttons is operated, the controller 14 reads, for example, the data for a first station out of plural stations for which data has been stored in sequence in the selected preset channel, to load the frequency divider of the PLL circuit with receiving-frequency data. If the same one of the preset channel buttons 25 is operated again, then the controller 14 reads the data for a second station in that same channel to load the frequency divider of the PLL circuit with the new receiving-frequency data. Assuming that frequency data for eight stations has been stored, operating the same one of the preent buttons 25 nine times makes one complete cycle of search for the frequency data stored in that channel and reverts to the first frequency data.

The procedure of a control method which is carried out by the processor of the controller 14, will now be described with reference to the flow chart shown in Fig. 7,

The processor first reads the data supplied from the error correction circuit 13 (step 51) and makes a decision based on whether or not the data is information associated with other networks (step 52). If the data is information associated with other networks, then the processor reads the store address codes D_2, D_1, D_0 in block 2 (step 53), and also reads AF data (step 54). Since one group can contain AF data of two stations as shown in Fig. 9, AF data of one or two stations of the same network can be read from a single group transmitted. Then a decision is made based on

whether or not autopreset has been specified by means of the autopreset button 23 (step 55). If autopreset has been specified, then the preset channel is set in accordance with the store address codes D_2, D_1, D_0 which have been read previously (step 56). Then a decision is made based on whether or not AF data for eight stations has already been written by means of autopreset in the preset memory area corresponding to the preset channel that was set in step 56 (step 57). If such AF data has not been written yet, then the AF data which has been read in step 54 is written in a vacant location of the preset memory area corresponding to the preset channel that has been preset in step 56 (step 58). If the AF data has already been written, then the AF data which has been read in step 54 will not be written. Repeating the procedure thus far described permits writing AF data of other networks for up to eight stations each in the memory area of the present channel, the stations being different from network to network.

In addition, the setting operation of preset channel in step 56 is effected, starting from preset channel 1ch in the order of D_2, D_1, D_0 of the store address codes which have been read after autopreset is commanded, for example. Also the users may be left with preset channel setting upon every change of the store address codes D_2, D_1, D_0, in which case it would be preferred to allow the users to command a preset channel, by having read the store address codes D_2, D_1, D_0 and all of the AF data of eight stations per network.

Further, although the store address codes D_2, D_1, D_0 can provide up to eight ($2^3 = 8$) sets of AF data for other networks, the number of other networks in excess of the number of the preset channels, i.e. six channels in the described embodiment, will be ignored, so as not to be stored. In the embodiment thus far described, all the frequency data in the memory area of a channel will be lost by specifying autopreset even if that channel has a memory area in which frequency data has been stored before autopreset is commanded. However the embodiment may be

modified in such a way that AF data for other networks is autopreset only in the preset channel in which rfrequency data has not been stored. Further, writing data in the preset memory area magy be effected not only every time AF data is read, but also after all the AF data of eight stations has been read. Still further, in the embodiment mentioned above, store address codes D2, D1, D0 are used as a category data of other networks, but PI codes may also be used.

Such a control method performs preset operations in which category data and station-frequency data of stations which belong to respective other networks are read from the broadcasting wave received; and when preset is specified, the station-frequencies of stations which belong to the same network are stored in addresses in a preset memory area corresponding to one preset channel. Therefore radio listeners can quickly select, by operating one of the preset channel buttons, a station of another network different from the network to which the station currently being received belongs.

Referring to Figure 10 the memory 15 may also have, in the RAM, a PI memory area for PI code for up to eight stations.

For example, PI code obtained from the data which was read from the broadcast, together with frequency data, can be written into the PI memory area in preset mode when the RDS broadcasting is being received. In this modification, operating the autopreset button 23 permits writing into the PI memory area a PI code which is read from the data supplied from the error correction circuit 13. Operating the autopreset button 23 also permits writing into the preset memory area PI codes different from preset channel to preset channel.

The control procedure of a modified control method, which can be carried out by the processor of the controller 14, will now be described with reference to the flow chart shown of Fig. 11.

In the case where the processor has caused the receiving frequency to change during station selection, the processor reads the data supplied from an error correction circuit 13 after the station selection is over (step 51), and the processor makes a decision based on whether or not the data is information associated with the other networks (step 52). If it is information associated with the other networks, then AF data is read (step 53) and a decision is made based on whether or not the number of AF data elements, n has been detected (step 54). Since a single group can contain AF data for two stations as shown in Fig. 9, transmission of one group permits reading of AF data of one or two stations of the same network. A group of AF data of a network consists of the number of AF data elements, or the number-of-stations data n (i.e. the number of stations up to 25 which can be received properly, the centre station of which being a data-sending station) followed by n frequency data elements, $f_1 \ldots\ldots f_n$ arranged in the order of location closeness to the station currently being received.

Decision making based on whether or not the number of AF data element, n is detected confirms detection of the first element of a group of AF data elements of one network. The first element of the group of AF data element may otherwise be detected from the fact that the store address codes D_2, D_1, D_0 have changed from their previous value.

When the first element of a group of AF data elements of a network is detected, a flag F is set to 1 (step 55), and a decision is made based on whether or not both codes C_1 and C_0 are 0 (step 56). If the first element of a group of AF data elements of a network has not been detected, then a decision is made based on whether or not the flag F is equal to 1 (step 57). If F=1, then it means that the first element of the group of AF data has already been detected, and the procedure proceeds to step 56. If C_1=C_0=0, then PI code is read since PI code, one of the

information elements associated with other networks is located in block 4 (step 58). Additionally, flag F is set to 0 upon completion of station selection. Then a variable m is set to 1 (step 59) and then PI memory area is checked to make a decision based on whether or not the PI code has been assigned to a preset channel, m-ch.

If the PI code which was read has not been assigned to a preset channel, m-ch yet, then the variable m is added 1 (step 61). Thereafter a decision is made based on whether or not the variable m is greater than 6 (step 62). If $m \leq 6$, then the processor reverts to step 60 to search for a preset channel to which a PI code has been assigned. If $m > 6$, then writing the AF data that has been read is not effected since there are no preset channels to which a PI code has been assigned. When a preset channel, m-ch is found to have already been assigned the same PI code as what is read, a decision is made based on whether or not AF data for eight stations which was read has been written into the preset memory area corresponding to the preset channel m-ch (step 63). If AF data for eight stations has not been written yet, then the AF data that has been read is written into a vacant memory area corresponding to the preset channel m-ch (step 64). If frequency data for eight stations has already been written, writing the AF data which has been read is not effected and the flag F is reset to 0 (step 65). By repeating the steps described above, the AF data of the other networks which has been stored in the preset memory area corresponding to preset channels, different from network to network, can be replaced by AF data of the other network obtained from the newly received RDS broadcasting signal when receiving frequency changes due to station selection.

Thus, as described above, with such a method for controlling an RDS receiver, category data of other networks and station frequency data of stations of the other networks is read from the newly received broadcasting wave after station selection is effected; and the station

frequency data of the other network which is read is substituted for the broadcasting frequency data which has been stored previously in the address of the preset memory, in which each preset channel is assigned a network different from others. Therefore it is easy to select a station of a network different from the network to which the station currently being received belongs. Since the station frequency data is transmitted in the order of location closeness to the centre station which is transmitting the data, data renewal always permits preset selection of stations which can be received with a good receiving condition.

In the parent application, GB-A-2208457, we claim a method of identifying which of a first method and a second method for transmitting station frequency data is being received by an RDS radio receiver, the first transmission method being of a type in which a group of blocks of data is transmitted sequentially in a repeated manner, each block containing station frequency data of two stations in a network of stations which broadcast an identical program, the frequency data for each block being different, and a first data element in a first block representing the number of stations in the network; and the second transmission method being of a type in which a plurality of groups of blocks of data are transmitted sequentially, the groups representing groups of stations defined on the basis of networks of stations broadcasting identical programs, each group consisting of a centre station and network stations in an area which can be received, and each block containing station frequency data for a pair of stations which are broadcasting an identical program to the other, one a centre station in that group and the other another station within that group, the method comprising:

reading station frequency data in the first and second blocks only from the data obtained by demodulating the received broadcasting wave; and

comparing the station frequency data in the first and second blocks for coincidence, coincidence of data indicating that the second method of transmission and non-coincidence indicating that the first method of transmission is being used for transmitting the data. An RDS receiver for carrying out this method is also claimed.

CLAIMS

1. A method of controlling an RDS radio receiver which is provided with a preset memory having addresses for a plurality of frequency data elements per preset channel, and which can receive an RDS broadcast including data signals indicative of categories and station-frequencies of a plurality of networks different from a network to which a station transmitting the RDS broadcast belongs, the method including the steps of:

sampling data signals from the received broadcast;

reading category data and station-frequency data of other networks from the sampled data; and

storing the station frequencies of network stations belonging to the same network in memory addresses in the preset memory corresponding to a preset channel when a preset instruction is given.

2. A method according to claim 1, further including searching for an address in the memory in which the same category data as the category data that is read from the RDS broadcasting when another station is selected and subsequently an RDS broadcast is received; and

revising data in the memory by writing in the respective address the frequency data for a station in the other network which is read from the broadcasting wave received.

3. A method according to claim 1, substantially as described with reference to Figures 1 to 5 and 8 to 11 of the accompanying drawings.

4. An RDS radio receiver which can receive an RDS broadcast including data signals indicative of categories and station-frequencies of a plurality of networks different from a network to which a station transmitting the RDS broadcast belongs, the receiver having:-

a preset memory having addresses for a plurality of frequency data elements per preset channel; and

means for sampling data signals from the received broadcast;

means for reading category data and station-frequency data of other networks from the sampled data; and

means for storing the station frequencies of network stations belonging to the same network in memory addresses in the preset memory corresponding to a preset channel when a preset instruction is given.

5. An RDS radio receiver according to claim 4, further comprising means for searching for an address in the memory in which the same category data as the category data that is read from the RDS broadcasting when another station is selected and subsequently an RDS broadcast is received; and

revising data in the memory by writing in the respective address the frequency data for a station in the other network which is read from the broadcasting wave received.

6. An RDS radio receiver according to claim 4, substantially as described with reference to Figures 1 to 5 and 8 to 11 of the accompanying drawings.